
टार और बिटुमिनस सामग्री के परीक्षण
के तरीके

भाग 1 लचीलापन का निर्धारण

(दूसरा पुनरीक्षण)

Methods for Testing Tar and
Bituminous Materials

Part 1 Determination of Ductility

(Second Revision)

ICS 75.140

© BIS 2023



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

March 2023

Price Group 5

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Bitumen, Tar and Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Product Division Council.

This standard was originally published in 1958 as ‘Methods for testing tar and bituminous materials — Determination of ductility. The first revision was carried out in 1978. ‘Methods for testing tar and bituminous materials’ was published as series of 22 standards in the form of a booklet, as listed below:

<i>IS No.</i>	<i>Title</i>
1201 : 1978	Sampling
1202 : 1978	Determination of specific gravity
1203 : 1978	Determination of penetration
1204 : 1978	Determination of residue of specified penetration
1205 : 1978	Determination of softening point
1206	Determination of viscosity:
(Part 1) : 1978	Industrial viscosity
(Part 2) : 1978	Absolute viscosity
(Part 3) : 1978	Kinematic viscosity
1207 : 1978	Determination of equiviscous temperature (EVT)
1208 : 1978	Determination of ductility
1209 : 1978	Determination of flash point and fire point
1210 : 1978	Float test
1211 : 1978	Determination of water content dean and stark method
1212 : 1978	Determination of loss on heating
1213 : 1978	Distillation test
1214 : 1978	Determination of matter insoluble in benzene (Withdrawn due to toxic nature of benzene)
1215 : 1978	Determination of matter insoluble in toluene
1216 : 1978	Determination of solubility in carbon disulphide trichloroethylene
1217 : 1978	Determination of mineral matter ash
1218 : 1978	Determination of phenols
1219 : 1978	Determination of naphthalene
1220 : 1978	Determination of volatile matter content

However, the committee responsible for the formulation of standards in the field of bitumen, tar and related products decided to publish these Indian standards separately for each test so as to make it user friendly.

The second revision has been taken up to keep pace with the latest technological development and international practices. In this revision following major changes have been made:

- a) Method for determination of elastic recovery has been incorporated in the standard.
- b) This standard has been divided into two parts as given below:
 - 1) Method for testing tar and bituminous materials: Part 1 Determination of ductility.
 - 2) Method for testing tar and bituminous materials: Part 2 Determination of elastic recovery.

The composition of the committee, responsible for formulation of this standard is listed in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

METHODS FOR TESTING TAR AND BITUMINOUS MATERIALS

PART 1 DETERMINATION OF DUCTILITY

1 SCOPE

This standard covers the method of determination of ductility of distillation residue of cutback bitumen, blown type bitumen and other bituminous products.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this draft standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
IS 334 : 2002	Glossary of terms relating to bitumen and tar (<i>third revision</i>)

3 TERMINOLOGY

3.1 For the purpose of this standard the following definition and those given in IS 334 shall apply.

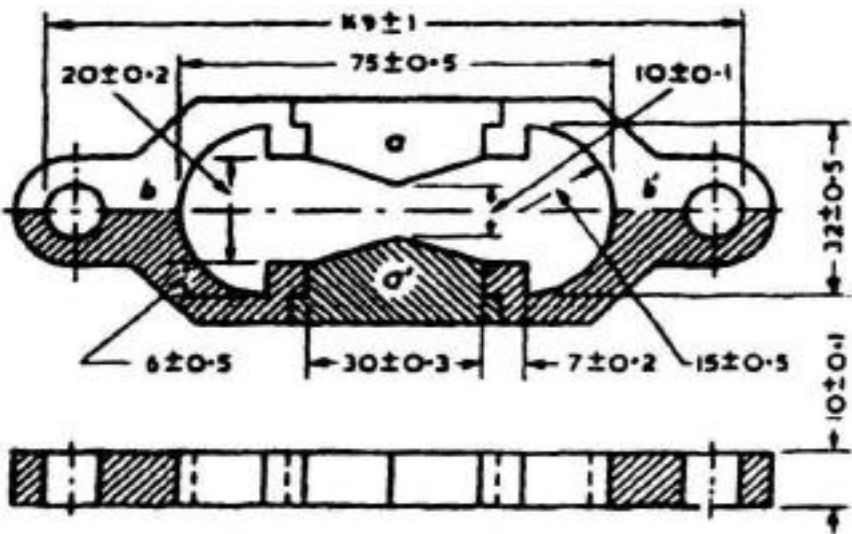
3.2 Ductility — The property by which a material

can be drawn in fine thread without breaking. For bitumen, it is measured by the distance in centimetres to which it will elongate before breaking, when two ends of a briquette specimen of the material of the specified form and cross-section are pulled apart under a specified speed and temperature.

4 APPARATUS

4.1 Mould — made of brass with the shape, dimensions and tolerances as shown in Fig. 1. The ends band *b'* are known as clips, and the parts *a* and *a'* as sides of the mould. The dimensions of the moulds shall be such that when properly assembled, it will form briquette specimen having the following dimensions:

Total length	(75.0 ± 0.5) mm
Distance between clips	(30.0 ± 0.3) mm
Width at mouth of clip	(20.0 ± 0.2) mm
Width at minimum cross-section (halfway between clips)	(10.0 ± 0.1) mm
Thickness throughout	(10.0 ± 0.1) mm



All dimension in millimetres.

FIG. 1 MOULD FOR DUCTILITY TEST

4.2 Water Bath — A bath preferably with a thermostat maintained within ± 0.1 °C of the specified test temperature, containing not less than 10 litres of water, the specimen being immersed to a depth of not less than 100 mm and supported on a perforated shelf not less than 50 mm from the bottom of the bath.

4.3 Testing Machine — For pulling the briquette of bituminous material apart, any apparatus may be used which is so constructed that the specimen will be continuously immersed in water as specified under 4.2 while the two clips are pulled apart horizontally with minimum vibrations at a uniform speed, as specified and with suitable arrangement for stirring the water for attaining uniformity in temperature.

4.4 Thermometer — Conforming to the following requirements:

<i>Characteristic</i>	<i>Requirement</i>
Range	0 °C to 44 °C
Graduations	0.2 °C
Immersion	65 mm
Overall length	(340 \pm 10) mm
Stem diameter	5.5 mm to 8.0 mm
Bulb length	10 mm to 16 mm
Bulb diameter	Not larger than stem diameter
Length of graduated portion	150 mm to 190 mm
Longer lines at each	1 °C and 5 °C
Figured at each 5 °C	5 °C
Scale	± 0.2 °C

NOTE — Any temperature measuring device meeting the resolution and temperature range requirement specified in the test method to be used.

5 PROCEDURE

5.1 Unless otherwise specified, the test shall be conducted at a temperature of (25.0 ± 0.5) °C and at a rate of pull of (50.0 ± 2.5) mm/min.

5.1.1 When a low temperature ductility test is desired, the test shall be made at a temperature of (4.0 ± 0.5) °C and at a rate of pull of (10.0 ± 0.5) mm/min.

5.2 Completely melt the bituminous material to be tested to a temperature of 75 °C to 100 °C above the approximately softening point until it becomes thoroughly fluid. Assemble the mould on a brass plate and in order to prevent the material under test from sticking, thoroughly coat the surface of the plate and interior surfaces of the sides of the mould (a and a' in Fig. 1) to prevent adhesion of bitumen

to the pouring plate when casting disks, the surface of the brass pouring plate may be thinly coated just before use with silicone oil or grease, a mixture of glycerin and dextrin, talc, or china clay. In filling, pour the material in a thin stream back and forth from end to end of the mould until it is more than level full. Leave it to cool at the room temperature for 30 min to 40 min, and then place in a water bath maintained at the specified temperature for 30 min after which cut off the excess bitumen by means of a hot, straight-edged putty knife or spatula so that the mould shall be just level full.

5.3 Testing

Place the brass plate and mould with briquette specimen, in the water bath and keep at the specified temperature for about 85 minutes to 95 minutes. Then remove the briquette from the plate, detach the side pieces, and test the briquette immediately.

5.3.1 Attach the rings at each end of the clips to the pins or hooks in the testing machine and pull the two clips apart horizontally at a uniform speed as specified until the briquette ruptures. Measure the distance in centimeters through which the clips have been pulled to produce rupture. While the test is being made, make sure that the water in the tank of the testing machine covers the specimen both above and below it by at least 25 mm and is maintained continuously within ± 0.5 °C of the specified temperature.

6 REPORT

6.1 A normal test is one in which the material between the two clips pulls out to a point or to a thread and rupture occurs where the cross-sectional area is a minimum. Report the average of three normal tests, as the ductility of the sample, provided the three determinations be within ± 5 percent of their mean value.

6.1.1 If the value of three determinations do not lie within ± 5 percent of their mean but the two higher values are within ± 5 percent of their mean then record the mean of the two higher values as test result.

6.2 If the bituminous material comes in contact with the surface of the water or the bottom of the bath, the test shall not be considered normal. Adjust the specific gravity of the water in the bath by the addition of either methyl alcohol or sodium chloride so that the bituminous material does not either come to the surface of the water, or touch the bottom of the bath at any time during the test.

6.3 If a normal test is not obtainable on three successive tests, report the ductility as being

unobtainable under the conditions of test.

7 PRECISION

7.1 Test results shall not differ by more than the following:

Repeatability	10 percent of the mean
Reproducibility	20 percent of the mean

8 PRECAUTIONS

8.1 The plate upon which the mould is placed shall be perfectly flat and level so that the bottom surface of the mould touches it throughout.

8.2 In filling the mould, care shall be taken not to disarrange the parts and thus distort the briquette and to *see* that no air pocket shall be within the moulded sample.

ANNEX A
(Foreword)

COMMITTEE COMPOSITION

Bitumen, Tar and Related Products Sectional Committee, PCD 06

<i>Organization</i>	<i>Representative(s)</i>
CSIR - Central Road Research Institute, New Delhi	DR AMBIKA BEHL (Chairperson)
Airports Authority of India, New Delhi	SHRI VINOD KUMAR SHARMA SHRI SUPRIO GOSH (<i>Alternate</i>)
Bharat Petroleum Corporation Limited, Mumbai	SHRI C. SHANMUGANATHAN Ms SONAL MAHESHWARI (<i>Alternate</i>)
Birla Institute of Technology and Science, Pilani	SHRI SRIDHAR RAJU
CSIR - Central Road Research Institute, New Delhi	DR SIKSHA SWAROOP KAR
CSIR - North East Institute of Science and Technology, Jorhat	DR SHASHI D. BARUAH DR B. P. BARUAH (<i>Alternate</i>)
Central Public Works Department, New Delhi	SHRI DIVAKAR AGRAWAL
Chennai Petroleum Corporation Limited, Chennai	DR V. SELVAVATHI SHRI H. RAMAKRISHNAN (<i>Alternate</i>)
Dilip Buildcon Limited, Bhopal	SHRI B. B. KAMESWARA RAO SHRI ANUSH K. C. (<i>Alternate</i>)
Directorate General Border Roads, New Delhi	LT COL NITIN CHANDRA JOSHI SHRI ARNAB CHAKRABORTY (<i>Alternate</i>)
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	SHRI VIVEKANAND SHRI ANIL KUMBHARE (<i>Alternate I</i>) SHRI SACHIN VINAYAK ZOPE (<i>Alternate II</i>)
Engineer in Chief Branch, New Delhi	SHRI R. JAYAPRASAD SHRI O. P. SRIVATAVA (<i>Alternate</i>)
G R Infra-Projects Limited, Gurugram	SHRI U. C. GUPTA
GP Global Asphalt Private Limited, New Delhi	SHRI RAJESH KUMAR JAIN
Highways Research Station, Chennai	Ms ER S. USHA DEVI SHRI ER S. YAMINI (<i>Alternate</i>)
Hindalco Industries Limited, Mumbai	SHRI HARSHAD KUMAR PANDIT
Hindustan Colas Private Limited, Mumbai	SHRI T. K. SUBHAASH SHRI K. G. RANGANATHA (<i>Alternate</i>)
Hindustan Petroleum Corporation Limited (HP Green R & D Center), Bengaluru	SHRI B. RAVI SHRI K. RAGHAVA KRISHNA (<i>Alternate</i>)
Hindustan Petroleum Corporation Limited, Mumbai	SHRI SANTOSH DHAKU BHOGALE
IRB Infrastructure Developers Limited, Mumbai	SHRI SUDHIR HOSHING SHRI JITENDER CHAUHAN (<i>Alternate I</i>) Ms SONALI SARKAR (<i>Alternate II</i>)

<i>Organization</i>	<i>Representative(s)</i>
Indian Institute of Petroleum, Dehradun	SHRI MANOJ SRIVASTAVA DR KAMAL KUMAR (<i>Alternate</i>)
Indian Institute of Technology Bombay, Mumbai	DR DHARAMVEER SINGH
Indian Institute of Technology Delhi, New Delhi	SHRI ARAVIND SWAMY
Indian Institute of Technology Madras, Chennai	DR J. MURALI KRISHNAN DR A. VEERARAGHAVAN (<i>Alternate</i>)
Indian Institute of Technology Roorkee, Roorkee	SHRI SHAM SUNDAR RAVINDRANATH
Indian Oil Corporation Limited - Refineries and Pipelines Division, New Delhi	SHRI S. SARKA SHRI K. MEDHI (<i>Alternate I</i>) DR MONIKA (<i>Alternate II</i>)
Indian Oil Corporation Limited, New Delhi	DR N. S. RAMAN
Indian Road Congress, New Delhi	SHRI S. K. NIRMAL SHRI R. V. PATIL (<i>Alternate</i>)
Indianoil Total Private Limited, Mumbai	SHRI PANKAJ KUMAR JAIN SHRI GAURAV GOGNE
Ministry of Road Transport and Highways, New Delhi	SHRI SANJEEV KUMAR SHRI VARUN AGGARWAL (<i>Alternate</i>)
National Institute of Technology, Warangal	SHRI VENKAIAH CHOWDARY DR S. SHANKAR (<i>Alternate</i>)
National Rural Roads Development Agency, New Delhi	SHRI B. C. PRADHAN
National Test House, Kolkata	SHRI VINAY KUMAR
Nayara Energy Limited, Mumbai	SHRI MRIGANKA TARAFDAR SHRI DHIRAJ GONDALIA (<i>Alternate</i>)
Om Infracon Private Limited, Guwahati	SHRI A. N. DAS
Ooms Polymer Modified Bitumen Private Limited, Gurugram	SHRI B. R. TYAGI SHRI PALASH KATHAL (<i>Alternate</i>)
Shell Bitumen India Private Limited, Gurgaon	SHRI NILANJAN SARKER
ZYDEX Industries Limited	SHRI AJAY RANKA SHRI VISHAL SALUJA (<i>Alternate I</i>) SHRI HIMANSHU AGARWAL (<i>Alternate II</i>)
<i>Director General, BIS</i>	SHRIMATI MEENAL PASSI SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (PETROLEUM, COAL AND RELATED PRODUCTS DEPARTMENT) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

Member Secretary
SHRI HARI MOHAN MEENA
SCIENTIST 'C'/ DEPUTY DIRECTOR
(PETROLEUM, COAL AND RELATED PRODUCTS DEPARTMENT) BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 2016* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website- www.bis.gov.in or www.standardsbis.

This Indian Standard has been developed from Doc No.: PCD 06 (17366).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

	Telephones
Central : 601/A, Konnectus Tower -1, 6 th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	{ 2323 7617
Eastern : 8 th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	{ 2367 0012 2320 9474
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	{ 265 9930
Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	{ 2254 1442 2254 1216
Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	{ 2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.